Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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Acute stress, behavioural symptoms and mood states among school-age children with attention-deficit/hyperactive disorder during the COVID-19 outbreak

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1. Introduction

Attention deficit hyperactivity disorder (ADHD) is one of the most frequently occurred neurobehavioral disorder among children (American Academy of Pediatrics, 2000), which has negative impact on a wide range of aspects including learning ability, interpersonal relationships, self-esteem, and emotions (Lecendreux et al., 2011; Wang et al., 2017). Previous meta-analysis showed that the prevalence of ADHD among children and adolescents in China was 6 % (Wang et al., 2017). In the event of COVID-19 outbreak, schools in China are shut down and students are restricted to staying at homes. Primary and secondary schools in China open online official educational websites in order to allocate students to continue the education (Xinhua Net, 2020). Children with ADHD face noticeable challenges during this period. Firstly, the loss of daily routine and the lack of interpersonal and social interaction could work as potential risk factors for mental health problems or could worsen ADHD symptoms. In addition, majority of the ADHD children receive care from primary care settings (Patel et al., 2017; Subcommittee on Attention-Deficit/Hyperactivity et al., 2011). Children with ADHD could not get timely and professional care from home setting. Most of the parents of these children can be assumed not to be the domain experts but are forced upon the educational responsibility in addition to handle all the children's emotional and behavioral problems 24/7. Moreover, the pandemic of COVID-19 is a serious challenge to everyone including the adults. Their worry of the situation may further exacerbate the children's psychological wellbeing and worsen their behavioural problems.

This study aims to investigate the mental health related conditions of children with ADHD during the COVID-19 outbreak. We hypothesised that children's ADHD symptoms could be significantly worse compared to normal state during school closedown. In addition, we examined what key variables are associated with the changed behaviours in this special time.

2. Method

A total of 241 parents of school aged children with ADHD diagnosis were invited to participate in this survey. The school aged children described in the study were 6–15 years old (M = 9.43, SD = 2.39), and there were 194 boys and 47 girls. The study obtained the ethical approval from Shanghai Xinhua Hospital.

The following information were collected (1) ADHD behavioural symptoms were measured by *Swanson, Nolan, and Pelham scale (SNAP-IV) – parent form,* (Gau et al., 2008). (2) The acute responses of children in the event of 2019-nCoV breakout was measured using *The Child Stress Disorders Checklist (CSDC)* (Saxe et al., 2003). (3) *Time allocation of children's activities* was measured the approximate time allocation on activities (including: studying, using electronic devices, entertainment without using electronic devices, and interacting with the parents). (4) *Mood state of the children and parents* were asked by a single item each, rated on a 1–4 scale, with higher score indicated worse mood. (5) *Attention to media coverage of the 2019-nCoV outbreak* how much attention the children and parent paid to media coverage of the 2019-nCoV outbreak was rated on a 1–4 scale.

3. Results

Children's ADHD behaviours during the COVID-19 outbreak were rated by their parents. A one-sample *t*-test revealed that the average of children's ADHD behaviours (M = 2.25, SD = 0.54) were significantly worsened in comparison to their normal state (95 % CI = 2.18–2.32 which was significantly higher than the rating of "2"—no difference), t (240) = 7.11, p < .001. Fig. 1 presented the reported severity of ADHD behaviours in comparison to normal state.

The bivariate correlations among the study variables were summarised in Supplementary Table 1. To examine the relationship between child's ADHD behaviours and acute stress, attention to media coverage, time allocation, and the mood state of children and parents, a stepwise regression analysis was conducted with ADHD behaviours treated as the DV and all the other variables IVs. The stepwise regression analysis determined a three-predictor model, with F(3, 237) = 31.73, p < .001, R^2 = 0.29. In particular, children's overall mood, B = 0.17, 95 % CI of B [0.11, 0.23], p < .001, parents' overall mood state, B = 0.13, 95 % CI of B [0.06, 0.20], p < .001, and children's study time, B = −0.09, 95 % CI of B [−0.15, −0.02], p = .010, significantly predicted children's ADHD behaviours.

4. Discussion

This is the first study focusing children with ADHD during the time

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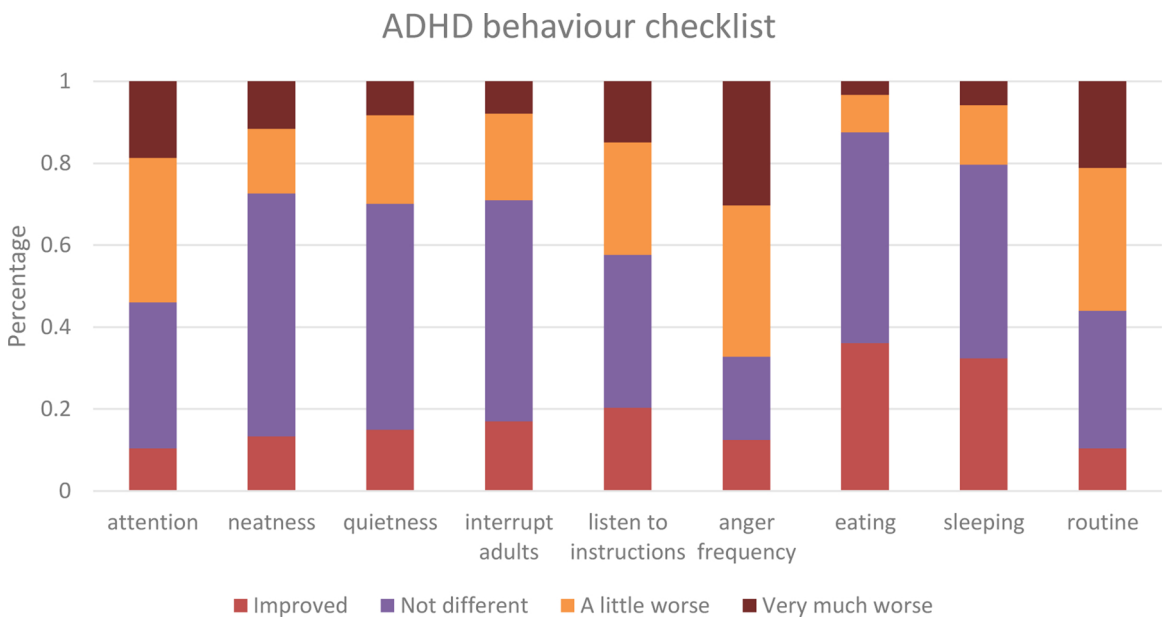

Fig. 1. Reported severity of ADHD behaviours in comparison to normal state.
Note. Parents were asked to rate on their child's behaviours in comparison to normal state in the following domains:
Attention: Is your child's ability to keep focused __?
Neatness: Is your child's ability to keep their room neat ___?
Quietness: Is your child's ability to work quietly ___?
Interrupt adults: Is your child's ability to keep the adults uninterrupted ___?
Listen to instructions: Is your child's ability to listen to instructions ___?
Anger frequency: Is your child's anger frequency ___?
Eating: Is your child's eating behaviour ___?
Sleeping: Is your child's sleeping behaviour ___?
Routine: Is your child's ability to keep routine ___?
Summary: the reported frequency of the 9 items were summarised in Fig. 1. There were 53.94 % parents reporting their children's ability to keep focused worsened, 67.22 % on increased anger frequency, 56.02 % on worse daily routine. Conversely, more than half of the parents reported that children's behaviours in other domains improved or maintained the same level.

of COVID-19 outbreak. During the COVID-19 outbreak, children's ADHD behaviours significantly worsened in comparison to their normal state.

In consistent with previous studies, we found children's negative mood state was associated with ADHD symptoms. Our results showed that parent's mood state also impact children's ADHD symptom. Researchers have indicated that parents of ADHD children experienced high level of daily child-rearing stresses (Pelham Jr and Lang, 1999; Yousefia et al., 2011). The special arrangement of school close-down and children staying at home might bring elevated difficulties and stress for both the children and their parents. Our results have significant clinical implication in placing the importance of treatment and control of negative mood.

The study time was negatively associated with the increase ADHD symptoms. During the COVID-19 duration, children are arranged to online studying at home. The results indicated that ADHD symptoms reduced with the longer study time. Although future studies are needed to confirm the results, this could be a potential strategy for decreasing ADHD symptoms for children at home. Conversely, the children who could use online study more effectively may be the ones who could focus longer; the mechanism of this association needs further investigation. In view of the rapid increase of online education accelerated by this pandemic, this direction of study is particularly useful.

The current study has several limitations should be noted. First, this was a cross-sectional study, and the casual relationship between ADHD symptoms and related factors cannot be confirmed. Second, data were reported by parents, rather than reported by children directly. It is possible that children may rate their own emotional and behavioural responses differently. Finally, the relationship between the worsened behaviours among children with ADHD and their medication status was not directly tested. Some parents feedbacked their concerns of the limited access to psychiatric medicine for their children during this special period. Future study must include clear criterion testing this association. Nevertheless, the support of special medicine for special-need groups should be prioritized during crisis like this.

In conclusion, during the COVID-19 outbreak, children's ADHD symptoms were significantly worse compared to normal state. The results alerted the important of focusing special vulnerable group during the disease outbreak. Attention is required for the identification of appropriate approach for ADHD children in terms of disaster risk reduction activities.

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Declaration of Competing Interest

None

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Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at https://doi.org/10.1016/j.ajp.2020.102077.

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